Fábián Zsófia Melánia

The analysis of the influence of neighbourhood in the European regional division of economic development

Main findings of the PhD thesis

Supervisor: Dr. Szabó Pál, assistant professor

Eötvös Loránd University Faculty of Science
Doctoral School of Earth Science
Head of doctoral school: Dr. Gábris Gyula DSc, professor of geography
Geography–Meteorology Program
Head of program: Dr. Nemes Nagy József DSc, professor of geography

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Introduction and objectives of the research

The aim of the thesis is the presentation and analysis of the status and change of the European and regional division of development with using multiple-variable-mathematical and -statistical methods. Within this wide topic the role of the geographical parameters appear as a significant aspect. Previous studies on the same subject also testify the importance of neighbouring influence on the division of improvement in Europe (Ertur & Le Gallo 2000, Tóth 2003, Szabó 2006), therefore, the neighbourhood out of the geographical parameters is the central topic of this study.

The main questions of the research are the followings:

- What does the idea of geographical parameters mean and which type of them could be differentiated?
- What kind of role do the geographical parameters have in the spatial examinations using mathematical-statistical methods?
- How did the spatial distribution of improvement or change in the EU between 1995-2009?
- Did the role of the neighbouring influence increase or decrease in the case of European regional economic distribution of improvement?
- What extra information do the methods give in examining the topic that are suitable for investigating neighbouring questions, and which differ from the most popular examination method (spatial autocorrelation)?
- How much better is a local model than a global one?

Methodology and data sources

The thesis means transition between theoretical and methodological studies, in some part one particular approach is in the foreground, while in other parts a different one. Accordingly, after a short introduction the calculation possibilities and limits of the methods are showed. Following this with their help the European spatial developing inequalities or neighbourhood questions will examined.

The methodology used in this study at the investigation of the European spatial developing inequalities was spatial inequality indicators and at the examination of the role of the neighbourhood the spatial autocorrelation was applied. First, it was tested globally if there is justification for further examinations, after this the calculations were continued locally.

Following with the regression method there was an experiment to search for the influencing variables of the development using more variables. The neighbouring parameters come to a role in connection with the correction of the basic model, using spatial lag, spatial error and geographically weighted regression models, the use of which offered more and more reliable models.

The data which was used along the study derived from the REGIO database of the Eurostat. In some cases it was completed with data of national statistical yearbooks and databases. The framework of the examined territories is based on the EU also adding some candidate countries, as well as concerning developmental matters Norway and Switzerland are also of special interest. (Regarding neighbouring matter Cyprus and Malta are difficult to examine therefore they were not calculated.) Due to the heterogeneous size of the examined territories as well as to gain a better interpretation of the results the NUTS level 2 and 3 were mixedly used in the examinations of regional levels. The period of the examination of inequalities and neighbourhood is 1995-2009, the regression analysis is concerned with 2009. The starting year 1995 as GDP data calculated with unified method of the state countries and regions of the EU have been available since then.

Regarding the indicators it should also be mentioned that the topic of the thesis the analysis of the influence of neighbourhood in the European regional division of economic development and in the calculations the GDP per capita and the rate of unemployment were used. A lot of literature criticized the suitability of GDP per capita (e. g. some researchers believe that this way the analysis of such a complex phenomenon is too much simplified). However, the main issue is the level of economic development. While the former is a broader concept GDP per capita is questionable indicator is this matter; in the case of latter one the quality feature of the indicator maybe shown better. The GDP per capita maybe regarded suitable to examine the economic development and that is also the most important indicator of regional underdevelopment (Nemes Nagy 1998, Szabó 2008). Naturally there is also criticism concerning its use (e.g. the location of production, commute, the unmeasured production, illegal work, in detail see Dusek – Kiss 2008, Szabó 2008), however despite its disadvantages it is still the most widely accepted economic development indicator.

Results and conclusions

1. What does the idea of geographical parameters mean and which type of them could be differentiated?

At the spatial analysis of the social-economic status and process in some cases the role of space was necessary to be taken into account separately in order to determine the cause and effect relationship. In these researches using mathematical-statistical methods, the factors which characterize the proximity need to be quantified. These numerical factors are called geographical parameters. According to this, by geographical parameters the factors which testify the importance of proximity are meant.

Distance is the most commonly used geographical parameter in the examinations. The interpretation and the measurement of distance could happen in different ways, which depend on the examination unit (settlement, region), the basis of the comparison, the type of distance and the spatial framework. Another important geographical parameter is the neighbourhood which means a special type of distance when the distance between two areas is zero. The neighbourhood is a type of connection in the basic case, and we could numerize this with dummy index. The third important geographical parameter is the location which means the spatial appearance of the relation between a spatial element and its surrounding. In the geographical space, the location is an idea which is interpreted the same way as position. Besides these we could count latitude and longitude among geographical parameters. These could appear in different ways as an individual, which means west-east and north-south positions. With their help we could count distance, or they may be used to determine location, neighbourhood, direction and shape.

2. What kind of role do the geographical parameters have in the spatial examinations using mathematical-statistical methods?

Based on the examined 150 articles, the roles of the geographical parameters prove to be important in investigations which use mathematical and statistical methods in spatial analysis.

The analysis of the articles leads to the following conclusions:

- articles concerned with general economic topic or with the topic of the service sector are typical of using geographical parameters;

- the three most frequently used geographical parameters are distance, neighbourhood, and location;

- the most frequently used methods are regression, or rather its spatial variations; autocorrelation and particular econometric models;

- in 133 articles it could be demonstrated, that proximity plays a role in the appearance of the phenomenon. The examination of the proximity gives significant extra information, principally in the topic of population distribution, migration, labour, transport, foreign direct investments, and search and development activities;

- in spatial development examinations used geographical parameters are also used, mainly focusing on neighbourhood. Its importance was proved several times, and in a lot of examinations methods based on neighbourhood is considered as the basis of calculations.

3. How did the spatial distribution of improvement or change in the EU between 1995-2009?

In the scope of the examination of the European regional economic division, the existing territorial differences and its change were surveyed with the assistance of three spatial inequality indicators (weighted relative variation, Hoover-index, Gini-coefficient) concerning the GDP per capita and unemployment rate. Regarding the direction of the process three periods may be differentiated in both variables.

Concerning GDP per capita apart from a fluctuation in 1998-1999 spatial equalization could be seen. As for unemployment rate, spatial equalization could be observed after 2001, then in 2009 the spatial differences increased again. However, it remains doubtful if it was a minor fluctuation or it meant a long-term change in the direction of the process.

Comparing the results concerning GDP per capita and unemployment rate the inequalities of unemployment rate are higher, and the differences decreased significantly than in the case of GDP per capita. With respect to time, parallelism could be observed in the change of spatial inequalities through the medium-strong correlation between the two variables. The reason of the contrasting spatial process at the end of the observed period is that as a consequence of the economic crisis, the more developed areas lowered production, thus the amount of the GDP per capita are constantly approaching that of the underdeveloped ones closer in the future too; not necessarily as a consequence of the rise of the underdeveloped areas, but of the regression of the more developed. In the case of the unemployment rate this is different from the case of the GDP per capita, because the underdeveloped areas were more influenced by dismissals.

Based on the differences within each county concerning GDP per capita spatial differences increased in most of the countries between 1995 and 2009, regarding the unemployment rate

the differences decreased between 1999 and 2009. In certain countries, capital city is outstandingly developed, so it is worth investigating how the spatial differences changed without the capital city or the region where it belongs.

As for the value of the GDP per capita, the difference is significant between the two values in those countries where the capital city and its surrounding area is significantly developed and does not have counterweight. The difference was small in those countries where there are more similarly weighted cities, so the spatial structure of the country is more equal. The omission of the capital city did not influence significantly the spatial inequalities within countries of the unemployment rate.

4. Did the role of the neighbouring influence increase or decrease in the case of European regional economic distribution of improvement?

On the basis of the spatial autocorrelated calculations it could be stated that the neighbours have a stronger influence on each other in Europe, investigating Moran's I values with the respect to both the GDP per capita and the unemployment rate, neighbouring connections are significant at present, as well as, the value of the neighbouring geographical areas are more likely to be similar to each other than to the geographical areas further away. However, this gradually weakens, the economic-developed picture is starting to become more mosaic-like consequently, the spatial structure of Europe nowadays is more similar to Kunzmann's „grape model" than Brunet's "blue banana".

In the case of GDP per capita the neighbouring connections are continuously losing from their significance, while regarding the unemployment rate the neighbouring effects have strengthened again since 2008, although it may not be predicted if this will be part of a longer process or not. The tendency of the GDP per capita is due to the prominent development of the central large city regions, as these regions are provided with better facilities and opportunities (a wider range of highly qualified workforce, good infrastructure, favourable investing possibilities), which enable them to improve faster than their surroundings. This way their similarity to the neighbourhood is decreasing, which tendency can also be perceived in all Europe (EC 2007). Parallely, as a consequence of the so "called backwash" effect the recession or slower development of the peripheral areas could be seen. Concerning the unemployment rate a change could be observed in its direction; the reason for which is that due to the economic crisis, there is an increase in the similarity of the neighbourhood since developed regions are evening out with the less developed regions. This is not true for the GDP per capita, because its realization is delayed compared to the unemployment. If we

compare the values of the Moran's I which was calculated to both of the variables we could see that in the case of the unemployment rate the change was much more significant, both in its volume and direction of the process.

After surveying the process taking place in whole Europe, with the assistance of LMI calculations the extent of the autocorrelated zones and the intensity of the autocorrelation were determined. Within this frame it was showed that regarding GDP per capita there was a shift towards the mosaic pattern, however, in the case of the unemployment rate no such significant changes were observed.

5. What extra information do the methods give in examining the topic that are suitable for investigating neighbouring questions, and which differ from the most popular examination method (spatial autocorrelation)?

These mean the models which are used to correct the autoregression models (spatial lag and spatial error models), and although these put the topic into a different perspective, than the autocorrelation, these give a better approach according to OLS regression, since their result is more reliable.

The regression examinations started with setting up an OLS model; the dependent variable was the GDP per capita which represents the state of development, and the independent variables were rate of economically active population, unemployment rate, population density and rate of who are employed in the service sector.

After testing the goodness of the model, it is revealed that it needs correction, so therefore, to eliminate the bias which mainly originated from the spatial autocorrelation, the calculation of spatial lag, and spatial error models followed. Within this framework, the autocorrelation problem of the error term has to be terminated. In the case of the spatial lag model it means improving the scope of the independent variables with a new one, which is the spatial lagged variation of the dependent variable. There is another option when the spatial lagged variation of the error term is taken into the model as a new variable; this is the approach of the spatial error model.

Finally, it could be stated, that the attempts of the correction of the model were successful, because both of the spatial lag and the spatial error model were significant, and in both cases the explained proportion increased compared to the OLS model. Out of the three models the spatial error model was the most reliable.

6. How much better is a local model than a global one?

If we consider the calculations of the Local Moran I (LMI) or the GWR, it could be seen that local models are suitable for the exploration of differences, which were obscured by the global model. Their use is important, because with their help the regional process is may be interpreted and it can determine what kind of regional variance is behind the global trends. In other words, it could be emphasized that the investigation question decides, if the global research will be enough.

The Local Moran I shows the strength of spatial autocorrelation on a local level, while with the assistance of Moran Scatterplot we may examine the similarity of the given geographical areas and their neighbours, as well as whether the similarity is caused by their low or high values.

With the help of GWR we could see the changing spatial pattern of the connection between dependent and independent variables, as we establish a model regarding all of the areas by the value of the neighbouring regions. In the case of this calculation the most important statement is that the R^2 values showed that the correspondences between variables are not equally true to all of the regions, in certain cases the connection is closer to the European trend, however, in other cases the adjustment is more uncertain.

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